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      A      RRRR  PPPP      A      N  N  EEEE  TTTT
     A A    R  R    P  P    A A    NN  N  E      T
    A  A  A  RRRR  PPPP    A  A    N  N  N  EEE    T
   A A A A  R  R    P      A A A A  N  NN  E      T
  A      A  R  R    P      A      A  N  N  EEEE    T

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      N  N  EEEE  W      W  SSSS
     NN  N  E      W      W  S
    N  N  N  EEE  W  W  W  SSSS
   N  NN  E      W  W  W  W  S
  N  N  EEEE  WW  WW  SSSS

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Issue 7

September 1973

ARPA Network Information Center
 Stanford Research Institute
 Menlo Park, Calif. 94303

ARPANET NEWS The Monthly Online/Hardcopy ARPANET Newsmagazine
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Issue 7 September 1973
Online version prepared weekly
Hardcopy version distributed monthly
Sponsored by: ARPA/IPT
Distributed by: ARPA Network Information Center
Stanford Research Institute
Menlo Park, California 94025
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Mil E. Jernigan (NIC)

The online version is sent to all Network members who receive online delivery from NIC. It can also be accessed by anyone who logs into SRI-ARC and uses the query language named NIC.

The online version contains the month's basic issue. Each week a branch is added, containing items received during the week. This update material is added to the new feature articles to produce the next month's issue.

For scanning on TTY:
control c
nic CR
a/rpanet news/ CR
s/how/ (whatever you choose from the contents) CR
(to stop printing) control o (to exit) q/uit/ CR
(to show statement numbers) v/:type View specs:/ mG CR

For printing NEWS:
nls CR
l/load/ f/file/ <nic>arpanewscover CR CR (for cover, masthead)
or
l/load/ f/file/ <nic>arpanews CR CR (for NEWS contents)
or
l/load/ f/file/ <nic>arpanewsup CR CR (for UPDATES only)
o/utput d/evice t/eletype/ CR

One hardcopy of the monthly issue will be sent to each Liaison, Principal Investigator, and Station Agent at Network Sites, and to Network Associates. Local reproduction is encouraged.

Contributions to the NEWS may be forwarded to JI at NIC through the Journal, to ISELI@USC-ISI, or to Jean Iseli, The MITRE Corporation, National Systems Design Dept. Westgate Research Park, McLean, Va. 22101. News may also be forwarded to JBN through the NIC Journal, or mailed to Jeanne North at SRI.

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CALENDAR Events of Network Interest
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Schedule

10/1-3 ACM-PROGLANG ACM Symp on Programming Languages
10/9-11 (EDUCOM) 9th Annual Conference, Princeton
10/15-17 IEEE
10/21-25 ASIS ASIS-73 Annual Meeting
11/5-7 IEEE-SYS Conference on Systems, Man & Cybernetics
11/7-8 ARCH Symp on High Level Language Computer Arch
11/12-13 TEXAS 2nd Texas Conf on Computing Systems
11/13-15 DATA-SYMP Third Data Communications Symposium
1/8-10 74 HAWAII-CON
5/6-10 74 NCC 1974 National Computer Conference

Meetings listed here without parenthesis were announced with some detail in earlier issues of the NEWS.

EDUCOM Ninth Annual Fall Council Meeting and Conference will be held October 9-11, 1973, in Princeton, New Jersey.

Advance registration may be accomplished by sending: Name, Telephone, Title, Affiliation, and Address to: EDUCOM, P.O. Box 364, Rosedale Road, Princeton, New Jersey 08540, with appropriate fee:

Member Institution	\$50.00
Nonmember Institution	\$70.00
Student Registration	\$14.00

The conference program is divided into four tracks:

- ...The Administration of Computing Resources..
- ...Computers in Instruction.....
- ...Management Information Systems...
- ...Computers in Research...

What's happening now in computing for colleges and universities? How are resources in computing for administration, instruction, and research in higher education likely to change? The program has been designed as a presentation of the facts on current use of computers on individual campuses for local use and in various resource-sharing arrangements. Although many case studies illustrate techniques for the management and use of resources, including networking, examples have been selected for the program on the basis of current activities which are felt to be the prologue for future development.

..... Extract by JI from Joe B. Wyatt's Chairman's Message.

ARTICLE Online Interview with Dr. Larry Roberts

The following is an edited typescript of an online interview at USC-ISI, with Dr. Larry Roberts, presently of ARPA/IPT, by Jean Iseli, on 6 September 1973.

ji: Dr. Roberts, I would like to prevail on you for some questions for the ARPANET Newsletter readership, if it is not too great an inconvenience? We understand you may be leaving ARPA/IPT shortly, is there anything that can be released about your plans, etc. at this time?

LGR: I WILL BE THE PRESIDENT OF TELENET AS OF OCTOBER 1.

ji: Is that the BBN subsidiary set up to commercially utilize the technology you were so instrumental in developing while at ARPA?

LGR: THE NETWORK TECHNOLOGY, YES. TELENET WILL BE A VALUE-ADDED CARRIER, GIVEN FCC APPROVAL.

ji: Your departure will be a great loss to the ARPANET, sir, but we would like to express our sincere best wishes for your future position. Do you expect to file with the FCC in the near future, or has that already been accomplished?

LGR: THE 214 IS ABOUT TO BE FILED.

ji: One last question, if the filing is approved, (1) how long would you estimate before TELENET is able to provide services to the public, and (2) will it be a heterogeneous network and if not, what types of computers will be utilized?

LGR: AFTER APPROVAL, IT SHOULD ONLY TAKE 9-12 MONTHS TO PROVIDE SERVICE IN AN INITIAL WAY. THE COMPUTER QUESTION IS MUCH AS IT IS IN THE ARPANET, ANY COMPUTERS THAT USERS WANT TO ADD CAN BE ADDED. CERTAINLY, IT SHOULD NOT BE HOMOGENEOUS.

ji: Dr. Roberts, thank you very much for according us the opportunity to chat with you.

LGR: THAT'S FINE.

ji: Thanks...and I wish you the very best of success in your new venture..will miss your leadership.

FEATURED SITE University of Illinois Center for Advanced Computation
=====

Description of the Work of the Site

---- By Dr. Michael S. Sher.

The Center for Advanced Computation is an interdisciplinary research center in the Graduate College of the University of Illinois at Urbana-Champaign. The Center's applied research and problem solving activities have been supported by the Department of Defense's Advanced Research Projects Agency (ARPA), the Ford Foundation, the National Science Foundation (NSF), and several other federal and state agencies. These activities include research and development in environmental information systems, economic modeling, energy studies, atmospheric modeling, image interpretation, transportation system modeling, statistical systems, graphics systems, computer network access systems, and numerical analysis. Since August 1972, over 90% of the computational resources required by Center staff has been obtained via the ARPANET.

As a complement to the ARPANET Terminal Interface Message Processor (TIP), the University of Illinois has developed a "mini-HOST" computer system based on the configuration of a small mini-computer (Digital Equipment Corporation PDP-11) acting as a full capacity HOST (from the protocol standpoint) and attached to a standard IMP or TIP. The PDP-11 based system is called the ARPA Network Terminal System (ANTS). ANTS provides facilities for attaching a wide variety of local input/output peripherals to any remote ARPANET HOST. Such peripherals include a variety of interactive terminals, card readers, line printers, plotters, magnetic tapes, disk storage, COM systems, graphics displays, etc. In addition, ANTS supports the attachment of integrated remote-job-entry systems whose components can be independently accessed from remote sites. ANTS may also serve as an intelligent network interface for larger computer systems.

In the summer of 1972, the Center discontinued the lease and operation of its B6700, which was costing about \$40,000 per month, and expanded its use to a variety of systems on the ARPANET. Service site costs have been about \$20,000 per month (half of which has been at UCSD), with an additional \$6,000 per month in communications and network access costs. It is projected that the Center's computational usage will continue to increase during the coming year. The ability to access and use different computer systems on the ARPANET, in our experience, has shown possible cost savings in programming labor and computer costs of 50 to 80 percent. Overall, it is estimated that to upgrade local University of Illinois research facilities to compete with currently used ARPANET service HOSTS (or establishing conventional, but comparable, remote links directly to unique service HOSTS) could only be accomplished at a cost exceeding 300% of the cost of services now obtained by the Center over the ARPANET.

Aside from the technical and economic aspects of choosing the proper set of computational facilities for solving particular problems, another aspect of networking is becoming quite important to the Center's research. The ARPANET has broadened the communications opportunities between the Center's staff members and geographically remote colleagues with ARPANET access. The ARPANET permits a broader community of collaborative and interactive research in those applications areas involving large scale computations. Researchers studying similar phenomena often use different machines, different numerical techniques, and different data bases with varying degrees of accuracy and documentation. It is often very difficult to distinguish computational and methodological differences between investigations into similar phenomena. The ability to jointly develop a common data base and to use common numerical techniques with the same machine(s) permits investigators to concentrate on the merits of differing methodologies without worrying about other side effects.

The Center's experience as a user of ARPANET resources has lead to the following opinions relative to the future of networking:

- (1) Networking should provide a variety of specialized services operated independently and in competition using a healthy free market to provide the best services at the lowest cost.
- (2) Networks should be operated in a manner which inhibits the formation of service monopolies (except for special resources like the ILLIAC IV) and encourages, whenever possible, the duplication of services.
- (3) Development of service sites which support different philosophies for providing very similar services should be encouraged.
- (4) Managing "complete" general purpose computing facilities generally combines the roles of the "wholesaler", who provides raw computational resources, and the "retailer", who molds these resources to meet the consumers needs. Universities are free to treat networks as wholesale outlets for computational resources while local staff play the retailer's role of molding the remote services and retaining local facilities required to best meet the demands of their students, professors, and administrators. We believe that the economics of this approach will encourage solutions of the political and administrative problems involved in making the transition from local dedicated computational facilities to networking.

Online Interview With John Day, ILL-ANTS

5b

The following is a brief online interview with John Day of the University of Illinois, Center for Advanced Computation, staff, conducted on Monday, 3 September 1973, concerning the current status of the ANTS Project. Readers are referred to the July issue of the ARPANET Newsletter for more information relative to the Army Material Command (AMC) ANTS work and to the referenced Development Corporation which is being set up to provide a technology transfer mechanism for the Center.

Ji: John, could you maybe tell us a little about your work on ANTS?

Day: We expect to start debugging this week. We have been plagued with hardware problems a lot this summer. Seems just about everything between Urbana and San Diego that could go wrong did.

Ji: Are you involved with the Belvoir ANTS?

Day: Indirectly. Bob Husby is the one primarily concerned with it. My prime responsibility is the file system, FTP, RJE, etc. And have been implementing related parts of the bowels of the system.

Ji: Are you concerned with the forthcoming "development corporation"?

Day: Yes. The Corporation should be set up by October.

Ji: Would you mind giving us a very brief, quick rundown on the basic concepts of the ANTS, and the "why" of an ANTS? Some of our readers are not completely familiar with the project and would be very interested.

Day: Basically, ANTS is an operating system that runs on any PDP-11. Originally, we were developing it because the TTP doesn't provide easy interfacing to devices such as graphics, RJE's, and the like ... not to mention the command language is a bit restricted. The present version which is running now was developed in a hurry in order to get Illinois on the Net and therefore is very minimal, but does allow us to RJE to CCN and fake such stuff to UCSD and ISI, with a little help from local programs. In fact we bring ANTS code files from UCSD to here via the Net, either to a 9-track tape, or directly to the disk. MARK II has been designed as a layered system that is incredibly modular, to allow just about any sort of device to be hooked on with a minimal amount of fums. One of the major advantages seems to be in the line of providing front ends and thereby avoiding for the larger machines the pain of writing an MCP. But it also provides pretty good RJE and FTP for whatever devices you have on it.

ji: How difficult is it to hang special peripherals onto ANTS?

Day: Should not be too difficult at all. Device handlers in ANTS all have a very characteristic structure and it is just a case of deciding what action to take for certain cases. To interface the RJE's for AMC takes about two man months of time to write and debug, I think. Of course, the more complex the device, the longer, so a new line printer doesn't take as long as an RJE, which doesn't take as long as a CDC-6600.

ji: Sounds very interesting. What facilities for microfilm storage and automated retrieval are there, if any? And what could be done to interface COM to it for document production?

Day: Well, presently we haven't been asked to think about it. But I doubt if it would be difficult at all, in fact might be a lot of fun to do.

ji: Is the development corporation going to be able to handle all the interest in ANTS?

Day: Hopefully. We have been hiring several new people and bringing in some we had on other projects. Really, most everything is in the interest state now. We are more flooded with people interested in finding out what ANTS is ...

ji: Sounds very GOOD indeed. Most of the contracts cycles can take anywhere from six to twelve months, which leaves you a little room to breathe.

Day: Yes. Which is good. There are a lot of things we want to do.

ji: Get the impression that few firm plans can be talked about right now. True, John?

Day: Yes. For the time being ... I would say that things will be much clearer in about a month or two with respect to both ANTS and the corporation.

ji: Fine. Incidentally, I like your Newsletter - very informative.

Day: Thanks. Will pass on the compliment. Will see you later.

ji: Thank you, John. It has been a real pleasure talking with you.

PROTOCOLS
=====

New TELNET Specifications

6

Revised TELNET Protocol and TELNET Option Specifications have been issued, which officially modify the existing specification and prepare for switchover to the new TELNET on 1 January 1974.

6a

The purpose of the Protocol is to provide a fairly general, bi-directional, eight-byte oriented communications facility. Its primary goal is to allow a standard method of interfacing terminal devices and terminal-oriented processes to each other. It is envisioned that the protocol may also be used for terminal-terminal communication ("linking") and process-process communication (distributed computation).

TELNET Options Specifications are issued as part of the protocol to permit sites to obtain more elegant solutions to the problems of communication between dissimilar devices than is possible within the framework of the Network Virtual Terminal (NVT). It is desirable that sites be able to invent, test, or discard options at will, even though the negotiation method permits the direct use of only 256 option codes. It is envisioned that options which prove generally useful will eventually be supported by many sites, and therefore it is desirable that they should be carefully documented and well publicized. A method of option code assignment, and standards for documentation of options are given. Option codes are to be assigned by Jon Postel.

.....excerpted by JBN from NIC 18639 and NIC 18640 issued August 1973 under the authority of Alex McKenzie BBN-NET.

Request from AEC for comments on their plans for FTP

6b

Several AEC installations are planning to enter the Network soon and are requesting comments on their proposal to implement local conventions for RJE to facilitate job entry without implementing RJE protocol at least at this time. (See NIC 17797 RFC 551 by Feinroth and Fink.)

RESOURCE NEWS
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News Items

Resource Sharing Exec, New Release by BBN

A new version of the Resource Sharing Executive (RSEEXEC) system has been distributed to ARPANET TENEX sites by BBN. The new version supports a number of new features. Chief among them is its ability to provide a distributed file system environment within which users may define and maintain file directories that span several network (TENEX) Hosts. In effect, RSEEXEC extends the range of many of the standard TENEX EXEC file system commands beyond the boundaries of the user's local TENEX to encompass all TENEX systems on the network.

Users who have been using the standard TENEX FTP user program to maintain files and directories on several TENEXs should find RSEEXEC an attractive alternative. Those who regularly access TENEX remotely from TIPS and use TIPCOPY to obtain listings of their files at their TIPS should find that the BIND, LIST and COPY (to LPT:) commands of RSEEXEC provide an alternative means to obtain such listings.

Users desiring more information on RSEEXEC are encouraged to login to their favorite TENEX, invoke RSEEXEC and type the command "HELP <CR>" which briefly explains how to obtain detailed information about RSEEXEC features. (TIP users may access RSEEXEC directly via the TIP "@n" command). Those interested in the design and implementation philosophy of RSEEXEC are referred to the paper "A Resource Sharing Executive for the ARPANET" presented at the 1973 National Computer Conference (also NIC 14689). Comments, suggestions and complaints should be directed to Bob Thomas (BTHOMAS@BBN) or Paul Johnson (JOHNSON@BBN).

RSEEXEC is by design an evolutionary system. the next major addition planned for the system is to make the distributed file system features, now available at the command language level, available at the executing program level.

..... Bob Thomas (BBN-TENEX)
CCN Makes 1970 Census Data Available

The 31 July 1973 issue of the CCN Newsletter, obtainable by phoning requests to: (213) 825-7548, is devoted to a description of the availability on the UCLA 91 of 1970 Census Data and assorted programs for retrieval.

.....Jean Iseli

Abstracts of Network Documents

---- Prepared by Mil Jernigan

7b

Stuart E. Madnick, (Sloan School of Management, Massachusetts Institute of Technology). The Future of Computers. In: Technology Review, p.35-45, July-August 1973. NIC 18586.

Highlighted are many of the advances, developments, and more recent changes in computer technology. Discussed are technological cost/performance breakthroughs in computer manufacturing; the evolution of computer system architecture for both hardware and software; and major steps toward meeting the requirements and capabilities of the user.

Eric M. Aupperle, (MERIT Computer Network, University of Michigan). The MERIT Network Re-Examined, MCN-0273-TP13, 11p. February 1973. (Report form of paper given at COMPCON '73 Conference, San Francisco, 27 February - 1 March 1973.) NIC 18585

There is considerable world-wide interest in planning and development of computer networks, and several technically different kinds of networks have been implemented. Little information indicating the influence of their designs on actual operational experience is available to guide other planning efforts. This paper reports on the heterogeneous, distributed MERIT Computer Network, and discusses some of the original MERIT design decisions.

Bertram Herzog, (MERIT Computer Network, University of Michigan). Organizational Issues and the Computer Network Market, MCN-0273-TP12. 7p. February 1973. NIC 18584

An exploration of problems and decisions involved in the establishment of the MERIT Computer Network which crosses organizational boundaries, is composed of heterogeneous equipment, and operates within a varied cost and economic structure. Some of the problems involved in starting a computer network and the constraints of inter-organizational issues are discussed.

Harry Erik (Michigan State University), Seymour J. Wolfson (Wayne State University), and Karl L. Zinn (University of Michigan). MERIT Computer Network, University of Michigan. Facilities and Resources Available Via the MERIT Host Computing Centers, MCN-0573-GE-14. 43p. March 1973. NIC 18583

A review of the facilities, capabilities, available services and programs on the MERIT Computer Network. Broad categories of services available to the network as a whole are described as well as features unique at the three hosts. The synergistic effect of combining the individual host resources into a unified network-wide operation is pointed out.

Philip H. Enslow, Jr. (Senior Staff Assistant, Office of Telecommunications Policy, Executive Office of the President). Non Technical Issues in Network Design - Economic, Legal, Social, and Other Considerations. In: Computer, Vol. 6, No. 8, August 1973, p.21-30. NIC 18561

A discussion of the managerial, operational, legal, social, economic, and other aspects of computer-communications networks. Multiple overlapping and interconnected networks can raise many managerial and administrative problems that must be solved in order that full and satisfactory use may be developed in a fast maturing technology. Standards of use and function should be set in what is now a wilderness of different equipment, methods, languages, and techniques. Five important points for management consideration of fundamental policy issues are given.

Einar Stefferud, (Einar Stefferud and Associates); David L. Grobstein, (Picatinny Arsenal), and Ronald P. Uhlig, (U. S. Army Materiel Command). Wholesale/Retail Specifications in Resource Sharing Networks. In: Computer, Vol. 6, No. 8, August 1973, p.31-37. NIC 18560.

Technical interest notwithstanding, the primary avowed reason for building general purpose computer networks has been to derive the benefits of sharing general purpose computer facilities among a large number of users. Advantages are both operational and managerial. A new functional structure of resource-sharing in computer networks is suggested, comparable to the wholesale-manufacturing and distribution and the retailing of goods to consumer, in that the network resources are spread through many channels and relayers before reaching their end users. Consumer concept differentiation is required in order that resources may be oriented toward consumer needs.

Thomas N. Pyke, Jr., R. P. Blanc, (National Bureau of Standards, Institute for Computer Sciences and Technology). Computer Networking Technology - A State of the Art Review. In: Computer, Vol. 6, No. 8, August 1973, p.13-19. NIC 18558.

Highlights of computer networking technology as represented in existing and planned networks are reviewed. This paper first identifies how they are configured and controlled, and concludes by summarizing several major challenges that now face network planners and designers. Of particular interest for future work are network design, routing strategies, better understanding of network flow control, new types of higher level protocols, channel allocation in large networks, mixed traffic studies, efficient use of multiaccess satellite channels, network interfacing, and network measurements and their techniques.

David J. Farber, (University of California at Irvine). Guest Editorial: The Three Faces of Computer Networks. In: Computer, Vol. 6, No. 8, August 1973, p.10-11. NIC 18557.

The long term impact of resource sharing networks in our society is yet to be determined. One of the potential outcomes of large scale resource sharing across major organizational boundaries could be a restructuring of the computer industry. Computer networks will have profound impacts on the nation's utility regulations, on corporate management, on the privacy of individuals, and on the organization of the industry itself. These impacts are considered in this special issue of Computer, dedicated to computer networking.

M. V. Zelkowitz and A. K. Agrawala, (University of Maryland). KWIC Index for Computer Networks. In: Networks, Vol. 3, No. 2, 1973, p.135-171. NIC 18554.

A comprehensive bibliographic KWIC list of most available references published through the end of 1972. Emphasis is on the design of store and forward computer networks, e.g., the ARPANET, but included are many related papers in the areas of data communications, timesharing systems, computer management and information systems. A KWIC Index, Author Index, and a bibliography are given.

James J. Andover. Futurism: For Fun and Profit. In: IEEE Spectrum, Vol. 10, No. 7, July 1973, p.37-38. NIC 18538.

Most educated men have begun to understand the imperatives of change. The future has become the subject of serious and respected study in recent years among a growing number of scientists, philosophers, social researchers, planners, and administrators. Forecasting is expected to be applied with increasing regularity in technology assessment, particularly since the U.S. Congress has created the Office of Technology Assessment to anticipate the impact of new technology. One of the chief tools to be used in this forecasting will be the various capabilities of the computer industry and computer networks.

David L. Retz (University of California at Santa Barbara, Computer Systems Laboratory). Programming the PDP-11 Very Distant Host for Use on ARPA-Style Networks. 6p. 8 August 1973. NIC 18242.

A description of the PDP-11 Very Distant Host interface device design and use. Details of the Control and Status Register (CSR) for both input and output are given.

PLANS

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IMP and TIP Additions and Changes

The following changes were announced by Alex A. McKenzie ((AAM)) :
BBN-NET : (617) 491-1850 x 4417 in NIC 18618, 22 August 1973.

- (1) UTAH will be changed to a TIP on September 6-7. The TIP address will be 132.
- (2) The current Aberdeen 316 IMP will be replaced by a 516 IMP on September 13-14.
- (3) The address of the MULTICS machine will be changed, at the discretion of site personnel, from 6 to 44 sometime after September 20.
- (4) A TIP will be installed at Wright-Patterson AFB on October 11.
- (5) The University of Michigan will be added as a Very Distant Host on the Case IMP on or after October 4; their address will be 77.
- (6) A Very Distant Host interface (address 95) will be added to CCA on December 6.
- (7) A Very Distant Host interface (address 130) will be added to SRI on December 6.
- (8) Belvoir will gain a second Host interface whose address will be 91.

AEC Plans to Enter the Network

Several Atomic Energy Commission installations are planning to enter the Network in the near future. These sites include Argonne National Laboratory (360/195), Lawrence Berkeley Labs (CDC 7600), and New York University (CDC 6600).

They are presently working to implement some local conventions to allow use of FTP to transfer a file, have it queued for execution, and return output and status information, and to avoid RJE protocol at this time. (see NIC 17797, RFC 551 by Yeshiah Feinroth and Robert Fink).

OTHER NEWS

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No contents this issue.

FORUM

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No contents this issue.

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